

Intra-African Trade*

William W. Olney†

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Abstract

The intra-continental trade share in Africa is only 12%, compared to 47% in North America, 53% in Asia, and 69% in Europe. This paper shows that the lack of intra-African exports cannot simply be explained by standard gravity equation terms. The analysis investigates possible explanations and identifies factors that promote trade between African countries. Intra-African exports are found to disproportionately increase with road infrastructure, trade agreements, and a less corrupt trading system. Diversifying the domestic economy away from natural resources and towards services is also associated with more intra-African trade. These results can guide efforts to promote African economic integration.

Keywords: intra-continental trade, exports, infrastructure, corruption, trade agreements, Africa

JEL Codes: F14, F15, O55

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†Williams College, wwo1@williams.edu.

1 Introduction

Africa accounts for 21.2% of the world's land and 13.7% of the world's people, but only 2.6% of the world's economic activity.¹ Understanding the causes of this disparity is one of the most important questions in economics (Collier and Gunning 1999, Acemoglu and Robinson 2010). One explanation is that Africa's lack of international trade slows economic development (Sachs and Warner 1997, Bosker and Garretsen 2012), for instance by limiting specialization, economies of scale, competition, and technology diffusion.

As former UN Secretary General Kofi Anan said “the main losers in today's very unequal world are not those who are too much exposed to globalization. They are those who have been left out.”² This is a concern for Africa, which accounts for only 2.7% of world trade. A closer look at the data reveals that the share of trade between African countries is especially small. The intra-continental trade share in Africa is only 12%, compared to 47% in North America, 53% in Asia, and 69% in Europe over the 1984-2016 period. This paper investigates why intra-African trade is relatively low.

According to the World Economic Forum and the African Development Bank, increasing intra-continental trade is one of the best ways of promoting economic development and growth in Africa.³ With this goal in mind, resources are devoted to fighting corruption, negotiating trade agreements like the African Continental Free Trade Agreement (AfCFTA), and building roads (\$4.6 billion per year).⁴ Despite the important policy implications and the significant time, money, and political capital dedicated to promoting economic integration within Africa, there is relatively little empirical evidence guiding these endeavors. This paper examines the determinants of intra-African trade and the results can inform efforts to alleviate the binding constraints to trade and growth (Hallaert and Munro 2009, Hausmann, Rodrik, and Velasco 2008).

The empirical analysis explores how changing conditions within African countries affects not only total exports but also bilateral exports to African and non-African countries. A comprehensive data set is assembled which covers 54 African countries, includes their trade with all 236 countries in the world, and spans the past three decades. Results show that intra-African trade has increased from 2% in 1984 to 15% in 2016. In addition, there are important differences across countries, with 35% of Kenyan exports

¹Calculations using the World Development Indicators database over the 1984-2016 sample period.

²Kofi Anan Speech at the UN Trade and Development Conference, February 11, 2000.

³See “Intra-African Trade is Key to Sustainable Development - African Economic Outlook,” African Development Bank, May 23, 2017; “Africa's Greatest Economic Opportunity: Trading with Itself,” Kingsley Makhubela, World Economic Forum, January 16, 2018; and also Bosker and Garretsen (2012) who find a positive correlation between African economic development and market access, particularly intra-African market access.

⁴Cervigni, Raffaello, Andrew Michael Losos, James L. Neumann, Paul Chinowsky. 2016. “Enhancing the Climate Resilience of Africa's Infrastructure: The Roads and Bridges Sector.” The World Bank working paper 110137.

but only 9% of Nigerian exports going to other African countries.

The paper examines factors that can explain these differences in the intra-African trade share, including trade agreements, infrastructure, the composition of the economy, corruption, conflict, and former colonial relationships. This incorporates the common hypotheses for the lack of African trade (Brookings 2012).⁵ The empirical analysis utilizes a panel-data set, a gravity empirical specification, and a rich set of fixed effects, which improves upon the cross-sectional studies common in this literature. However, the main contribution of the paper lies not in the methodological approach or the identification strategy but rather in the policy relevant findings themselves.⁶

The first result shows that the lack of intra-African trade is not simply due to the fact that Africa is a large continent with many developing countries. In other words, the common gravity terms of distance and economic size alone cannot explain the lack of trade between African countries. For example, distance is a larger impediment to trade between two African countries than between an African and a non-African country. The paper examines possible explanations for these findings and identifies ways to increase intra-African trade.

Trade agreements can increase bilateral trade flows by reducing tariff barriers (Baier and Bergstrand 2007), which may be especially important in Africa (Rodrik 1998, Carrere 2004). The analysis examines how different types of trade agreements (i.e. non-reciprocal, preferential, and customs unions) affect bilateral exports to African and non-African countries. The results show that exports to African countries increase with preferential trade agreements, but export to Non-African countries do not. This indicates that trade agreements between African countries may be an effective way of promoting intra-continental trade.

Poor infrastructure can impede trade (Donaldson 2018) especially in Africa (Limao and Venables 2001). Underdeveloped communication and transportation infrastructure linking African countries may explain why distance is a larger impediment to intra-African trade.⁷ The findings confirm that exports to African countries increase with infrastructure improvements. Specifically, one of the strongest results to emerge from this analysis is the large positive relationship between the network of roads and exports to other African countries. Exports to both African and non-African countries also increase with cell-

⁵Another potential explanation is that informal trade leads to an underestimate of intra-African trade flows. While it is challenging to obtain measures of informal trade, its prevalence likely depends on many of the factors (i.e. corruption, red tape, and trade agreements) which are examined in this analysis.

⁶This is a good example of an important topic that has been understudied due to empirical challenges (i.e. a 'sin of omission' according to Akerlof 2020).

⁷Infrastructure (Storeygard 2016), trade costs (Atkin and Donaldson 2015), and search and contracting frictions (Startz 2018) all influence *intra-national* African trade. This paper differs from these studies by focusing on *international* trade and especially the destination of these export flows.

phones.⁸

The composition of the domestic economy may influence African trade flows (Imbs and Wacziarg 2003, Cadot et al. 2011, Brookings 2012). The results show that growth in the natural resource and agricultural sectors is positively related to overall exports, and in particular exports to non-African countries. However, exports to other African countries decline with the natural resource sector. Production of a similar set of homogeneous products, which are in high demand in developed countries, may provide little incentive to export to a neighboring African country. On the other hand, countries that specialize in services tend to export relatively more to other African countries. These findings indicate that diversifying the economy out of natural resources and into services is one way to promote intra-African trade.⁹

Corruption and conflict generates an uncertain business environment which can adversely affect international trade (Dutt and Traca 2010). The results show that both factors decrease African exports overall. Exploiting the bilateral nature of the data set, there is also evidence that exports to African countries disproportionately decline with trade corruption and to a lesser extent conflict deaths. These findings suggest that corruption is an important impediment to intra-African trade.

European colonialism has lasting economic implications (Acemoglu, Johnson, and Robinson 2001), which can influence trade flows (Head, Mayer, and Ries 2010). The findings in this paper show that African exports to a former European colonizer are initially larger after independence but they steadily decline over time. Forty years after independence, African countries no longer disproportionately export to their former colonizer. As the impact of extractive institutions and infrastructure fade and trade networks with the former colonial power dissipate, African trade slowly evolves away from the European colonizer.

Utilizing a comprehensive data set and a rigorous empirical specification, these findings provide new insight into ways to effectively promote intra-African trade. Exports to other African countries disproportionately increase with roads, trade agreements, diversification away from natural resources and into services, and declining corruption. These results can guide efforts to promote African economic integration.

This paper makes a number of contributions to the existing literature. First, studies have identified a lack of market access and trade as an important impediment to African growth (Sachs and Warner 1997,

⁸Land phones, internet, and air infrastructure are found to be insignificant predictors of bilateral trade and data on rail and port infrastructure is sparse.

⁹Furthermore, diversification of the domestic economy away from agricultural and natural resource products may promote economic growth (Hausmann, Hwang, and Rodrik 2007). Collier and Venables (2007) also argue that African countries should diversify, but into manufacturing rather than services.

Collier and Gunning 1999, Bosker and Garretsen 2012). This paper contributes to this broader literature by examining why African countries do not trade more.¹⁰ The analysis pinpoints the component of trade that is lacking (i.e. intra-African trade) and identifies the factors that are most successful at promoting trade between African countries.

Second, the lack of African trade according to some papers is explained by economic size and distance (Foroutan and Pritchett 1993, Coe and Hoffmaister 1998, Rodrik 1998), while others find that intra-African trade is less than these gravity terms predict (Limao and Venables 2001, Redding and Venables 2004). One feature of this literature, which may contribute to the conflicting results, is that these studies rely on cross-sectional gravity specifications where confounding factors are more problematic.¹¹ Instead, this paper utilizes a panel data set to examine how changing conditions in African countries affects bilateral exports after accounting for a rich set of fixed effects (including country-pair fixed effects, year fixed effects, and in some specifications exporter*year and importer*year fixed effects as well). The results contribute to this literature by showing that intra-African exports fall more rapidly with distance, compared to exports to non-African countries.¹²

Third, to the best of my knowledge this is the first analysis that incorporates a variety of explanations for the lack of intra-African trade into a unified empirical analysis.¹³ Recent improvements in the availability and quality of African data make this type of unified analysis feasible and it means more sophisticated estimation strategies can be used. An appealing aspect of this empirical approach is that it is possible to identify the most effective ways of promoting intra-African trade, which may be useful to policy makers who often face constraints on the set of possible reforms.

The paper proceeds as follows. The next section discusses the data used in this analysis, including the bilateral trade data and measures of economic conditions within African countries. Section 3 presents a variety of descriptive statistics that show how Africa compares to other continents, how intra-African trade differs across countries, and how intra-African trade has evolved over time. The empirical strategy and estimating equation is outlined in section 4. Section 5 reports the main results and identifies the factors that are found to be important determinants of intra-African trade. Finally, section 6 provides some concluding thoughts.

¹⁰See Easterly and Reshef (2016) for examples of African export success stories.

¹¹Redding and Venables (2004) have a panel data set but use a repeated cross-sectional specification that does not account for bilateral-pair fixed effects. In addition to using a more rigorous estimation strategy, this paper picks up where Redding and Venables (2004) left off by identifying the “domestic factors (some of them subject to policy control)” that “determine export performance” in Africa.

¹²This is consistent with results showing that the factors influencing foreign direct investment differentially affect African countries (Asiedu 2002).

¹³Typically papers focus on one preferred explanation and largely ignore other possible determinants.

2 Data

This section outlines the data used in the empirical analysis, including both the bilateral trade data and the African country characteristics.

2.1 Bilateral Trade Data

Bilateral trade data for the years 1984-2016 is obtained from the commonly used World Trade Flow (WTF) data set.¹⁴ The analysis focuses on African export flows in U.S. dollars. The sample includes 54 African countries and their bilateral export flows to all 236 trading partner countries in the world.¹⁵ However, similar results are obtained when focusing only on sub-Saharan African countries or restricting the sample of trading partners to larger countries.¹⁶ The empirical analysis will examine how total exports, as well as exports to African and non-African countries, respond to changing domestic conditions.

2.2 African Country Characteristics

African country characteristics are gathered from a variety of data sources. The basic gravity terms of Gross Domestic Product (GDP) and population come from the World Development Indicators (WDI) database provided by the World Bank. Distance data comes from the French Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) and measures the population weighted distance (in kilometers) between all countries.

Trade agreement data for African countries is obtained from the Economic Integration Agreements (EIA) database (2017).¹⁷ An appealing feature of this data is that it includes information on various different types of trade agreements including non-reciprocal agreements, preferential trade agreements (PTA), free trade agreements (FTA), and customs unions. This provides an opportunity to examine how the type of agreement differentially effects export flows to African and non-African partners.¹⁸ Using the EIA's index, four binary trade agreement variables are constructed which are nested from least to most

¹⁴The WTF data set improves upon the underlying United Nations COMTRADE data and is available at: <https://www.robertcfeenstra.com/data.html>. The WTF data overcomes data quality issues associated with the COMTRADE data, such as discrepancies in the importer and exporter reports (Feenstra et al. 2005), and it avoids the numerous zeros in the African bilateral product-level export data. While the COMTRADE and BACI (from CEPII) data sets do have product level trade flows, this is not needed for this analysis on intra-African trade and the latter data set is only available post-1995.

¹⁵See Table A1 in the appendix for the sample of African countries included in the analysis.

¹⁶Results available upon request.

¹⁷This data is provided by the Kellogg Institute at the University of Notre Dame.

¹⁸Note that some types of agreements are only relevant for trade between an African and non-African country (i.e. non-reciprocal agreements) while others are only relevant for trade between African trading partners (i.e. customs unions). There is also information in the EIA database on common markets and economic unions but these are rare in Africa.

trade integration.¹⁹

The analysis explores how specific components of transportation and communication infrastructure affects African trade. Transportation infrastructure includes a measure of the total network of roads in kilometers from the World Bank’s Africa Development Indicators (ADI), and a measure of air transportation defined as the number of registered air departures (from the WDI).²⁰ Communication measures include internet users, mobile cellular subscriptions, and fixed telephone subscriptions (from the WDI). While there are other infrastructure variables in the WDI database, these are the measures that have the best coverage.

To investigate whether the composition of the domestic economy influences export flows, data on the value added in the agriculture, natural resource, manufacturing, and service sectors (as a share of GDP) is gathered from the WDI. Using these shares and the GDP of the country, the size of each domestic sector is calculated.

Corruption is measured using trade related components of the Doing Business (DB) index and the Logistic Performance Index (LPI), both from the World Bank. Specifically, a ‘trade corruption’ measure is constructed using a subindex from the DB data set on the time and costs associated with trading across borders (which includes documentary compliance, border compliance, and domestic transport, but not tariffs). A ‘customs corruption’ variable is constructed using a subindex from the LPI on the efficiency of the customs clearance process (i.e. speed, simplicity, and predictability).²¹

The analysis utilizes two measures of conflict. The number of armed conflict deaths within the country is measured using data from the Uppsala Conflict Data Program. A composite index on the severity of violence within the country is obtained from the Center for Systemic Peace, and is measured as the sum of international war, international violence, civil war, civil violence, ethnic war, and ethnic violence.

Finally, the paper explores the extent to which European colonialism influences current trade patterns. Using CEPII data, the number of years since independence from a European colonizer is identified for each African country, with a maximum of 60 (Head, Mayer, and Ries 2010).²² Independence dummies ($Indep1_{ijt}$ to $Indep60_{ijt}$) are constructed to capture the effect of years since independence on bilateral trade to a former European colonizer.

Combining these variables generates a data set spanning 54 African countries, 236 trading partner

¹⁹See the data appendix A.4 for additional data details.

²⁰The network of paved roads does not increase exports above and beyond the impact of the overall network of roads. The WDI also has some information on rail lines and shipping container traffic but due to severe data limitations (many African countries have no railroads or ports) these variables are less useful for this analysis.

²¹See the appendix section A.4 for additional data details.

²²See Table A2 for the list of European colonizers, African colonies, and the dates of independence since 1900.

countries, and 33 years (1984-2016). The list of African countries is reported in Table A1. Summary statistics of the gravity terms, the trade agreement variables, the infrastructure measures, the sectoral variables, the corruption measures, and the conflict variables are reported in Table A3. Finally, additional details about the data sources, the variables, and their coverage are in appendix section A.4.

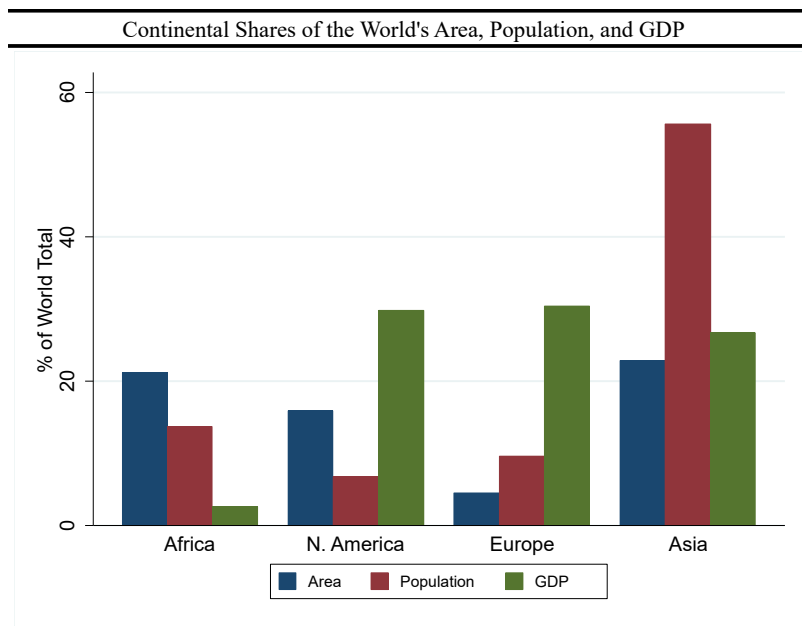
3 Descriptive Evidence

3.1 Continental Comparisons

It is well documented that Africa’s share of the world economy is relatively small. As seen in Figure 1, Africa represents 21.2% of the world’s land, 13.7% of the world’s people, but only 2.6% of the world’s GDP. In terms of geographic size and population, Africa is larger than both North American and Europe. However, North America, Europe, and Asia each comprise about 30% of global economic activity, while Africa represents less than 3%.

The underlying causes of Africa’s low share of world GDP is open to debate (see for instance Collier and Gunning 1999, Acemoglu and Robinson 2010). One prominent explanation is that Africa is not well-integrated into global markets via international trade (Sachs and Warner 1997).

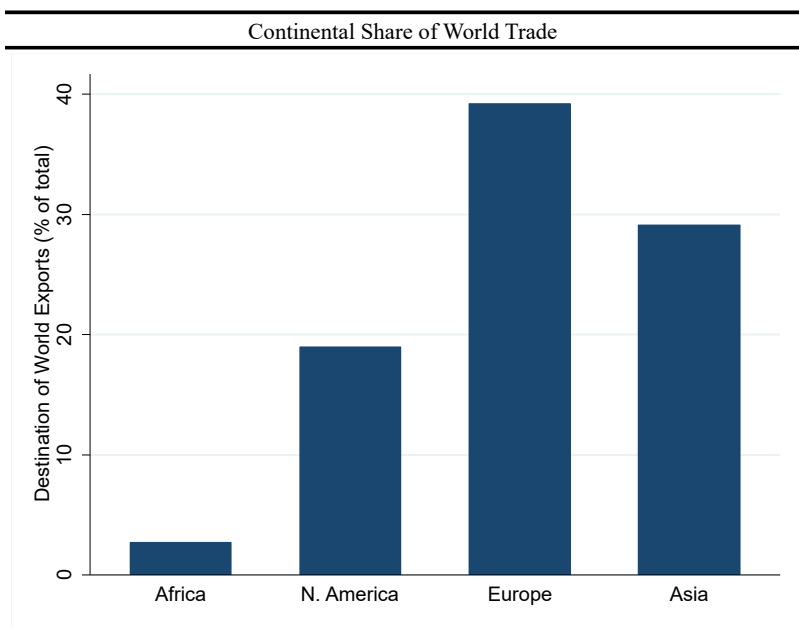
FIGURE 1



Notes: Land Area (sq. km), Population, and GDP (current US\$) from the World Bank’s World Development Indicators (1984-2016).

Figure 2 shows that the share of global exports going to African countries was 2.7% over the 1984-2016 period. In contrast, the share of exports bound for North America was 19%, the share headed to Europe was 39%, and the share going to Asia was 29%. These findings are consistent with concerns that a lack of Africa trade could in turn be slowing economic growth, by limiting specialization, economies of scale, competition, and technology and knowledge diffusion. While this descriptive evidence does not imply a causal relationship, it does suggest that African trade warrants attention.

FIGURE 2



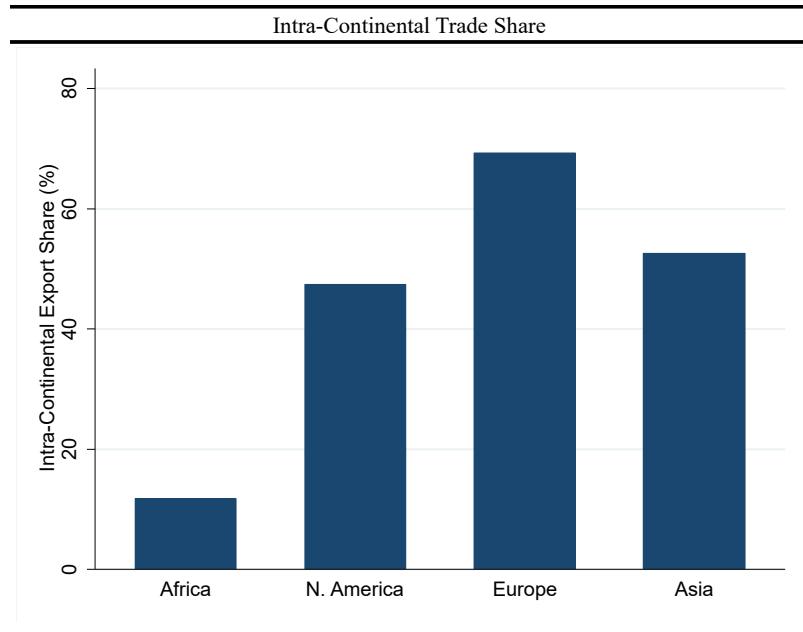
Notes: Authors calculation using World Trade Flow data from 1984-2016.

3.2 Intra-African Trade

A closer examination of the data reveals that Africa’s low global trade share is due to a lack of trade between African countries. Specifically, Figure 3 shows that the share of intra-continental trade in Africa is 12%, compared to 47% in North America, 53% in Asia, and 69% in Europe over the 1984-2016 period.²³ This paper examines why the intra-continental trade share in Africa is four to six times lower.

²³Note that the shares are similar in North America, Asia, and Europe, despite the fact that the number of countries within these continents vary. The intra-continental trade share in South America (21%) is also much higher than in Africa.

FIGURE 3

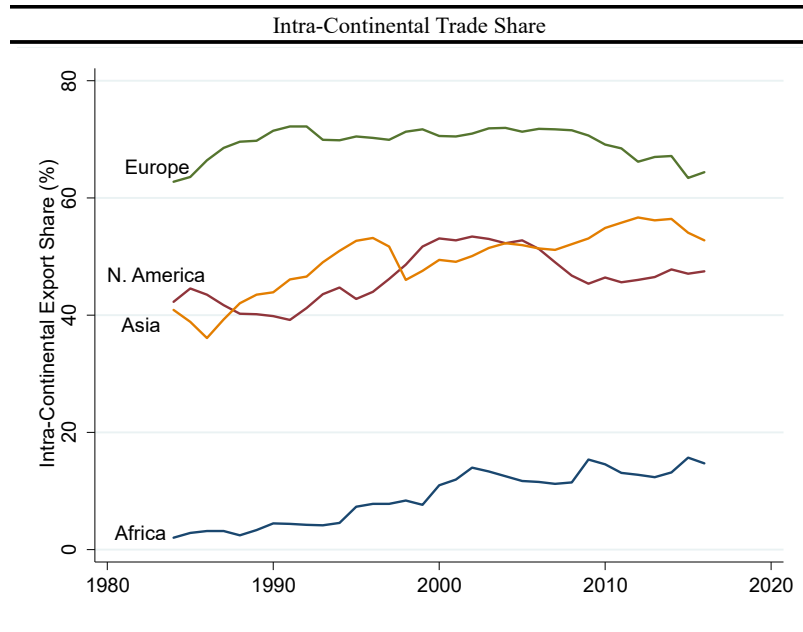


Notes: Authors calculation using World Trade Flow data from 1984-2016.

Figure 4 plots the change in intra-continental trade over time. Intra-European trade has remained relatively high and stable over the sample period. North American and Asian intra-continental trade has increased from 42% to 47% and from 41% to 53%, respectively.²⁴ Intra-African trade is low by comparison but it did increase from 2% in 1984 to 15% in 2016. The subsequent analysis will explore what factors have contributed to this increase in trade between African countries.

²⁴The growth of North American and Asian supply chains likely contributes to the rise in these intra-continental trade shares.

FIGURE 4



Notes: Authors calculation using World Trade Flow data from 1984-2016.

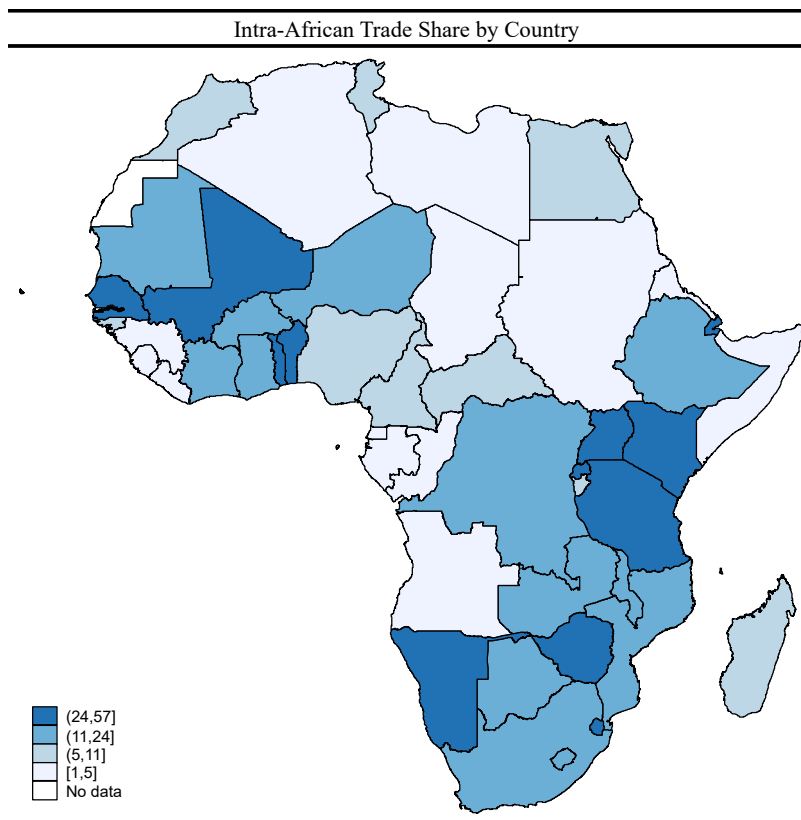
There is also geographic variation in the intra-continental trade share across African countries, as shown in Figure 5. At the high end, 43% of Zimbabwean exports go to other African countries.²⁵ This may be related to improved transportation infrastructure (i.e. the Alfred Beit Road Bridge in 1995) linking Zimbabwe with South Africa, one of its largest trading partners.²⁶ Kenya and Uganda send about a third of their exports to other African countries, perhaps because they are both part of the East African Community customs union. On the other hand, Nigeria’s relatively low intra-African trade share (9%) may be due to their focus on oil which is in high demand in developed countries.²⁷ These and other possible explanations will be explored more systematically in the analysis that follows.

²⁵Eswatini (57%) and Togo (45%) are the only African countries with a higher intra-African export share.

²⁶South Africa’s intra-African export share is 21%.

²⁷The intra-African trade share is also low in other oil producing countries (i.e. 2% in Libya, 3% in Angola, 3% in Algeria, and 10% in Egypt). Results in Table 4 confirm that exports to non-African countries disproportionately increase with growth in the natural resource sector.

FIGURE 5



Notes: Authors calculation using World Trade Flow data from 1984-2016. Percent of total exports going to other African countries.

4 Empirical Specification

The gravity equation is one of the oldest and most successful empirical relationships in economics (Tinbergen 1962). In its basic form bilateral trade is regressed on the size of the respective countries and the distance between them. This “naive” gravity approach (Anderson 2011, Head and Mayer 2014) was typically used in cross-sectional studies of African trade (Foroutan and Pritchett 1993, Coe and Hoffmaister 1998, Rodrik 1998, and Limao and Venables 2001). However, Anderson and van Wincoop (2003) showed that a theoretically grounded gravity equation needs to also account for multilateral resistance, and the failure to do so leads to the “gold medal mistake” in early gravity papers (Baldwin and Taglioni 2007). Multilateral resistance can be accounted for by including proxies for “remoteness” or by including importer and exporter fixed effects (Head and Mayer 2014).

More sophisticated gravity specifications have moved away from cross-sectional analyses and towards

more dynamic approaches that utilize panel data.²⁸ This allows bilateral-pair fixed effects to be included, which control for all unobserved time-invariant factors that affect trade between any two trading partners (i.e. geography, language, and culture). This approach identifies factors that change bilateral trade over time *within* a pair of countries.

Finally, the original approach of estimating the gravity equation using ordinary least squares (OLS) has been shown to be biased due to heteroskedasticity and the presence of zero bilateral trade flows (Head and Mayer 2014, Santos Silva and Tenreyro 2006). Instead, the following equation will be estimated using the preferable Poisson Pseudo-Maximum-Likelihood (PPML) estimator (Santos Silva and Tenreyro 2006, Fally 2015).

$$(1) \quad Exports_{ijt} = \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 \ln X_{it} + \beta_4 \ln X_{it} * AfricanImporter_j + \gamma_t + \gamma_{ij} + \varepsilon_{ijt}$$

where $Exports_{ijt}$ are exports from African country i to foreign country j in year t .²⁹ Exports are regressed on the log of GDP and population in both the exporting (Y_{it}) and importing (Y_{jt}) countries. In basic specifications that do not include the bilateral-pair fixed effects, the log of the population weighted distance between country i and j is also included in equation 1.

The vector X_{it} includes domestic conditions in the African country that may influence bilateral trade, such as infrastructure, the composition of the domestic economy, corruption, and conflict.³⁰ These domestic conditions (X_{it}) are also interacted with $AfricanImporter_j$, which is a binary variable indicating that the trading partner country is also in Africa. The coefficient β_4 provides insight into whether a particular domestic characteristic disproportionately affects bilateral exports to other African countries.

Also included in equation (1) are year fixed effects (γ_t) and bilateral-pair fixed effects (γ_{ij}). In some specifications, exporter*year (γ_{it}) and importer*year (γ_{jt}) fixed effects are included as well, which is the most rigorous approach for controlling for multilateral resistance (Baldwin and Taglioni 2007). The downside is that the exporter*year fixed effects subsume the African country characteristics (X_{it}), making it impossible to examine how factors like infrastructure and corruption affect overall trade.³¹ In light of

²⁸Carrere (2006) demonstrates the benefits of using panel data when studying the impact of trade agreements.

²⁹Focusing on uni-directional trade is more consistent with the goal of this analysis and it avoids the “silver medal mistake” identified by Baldwin and Taglioni (2007).

³⁰The analysis also includes trade agreements and years since independence from a European colonizer, both of which vary at the exporter-importer-year (ijt) level. Conditions in the importing country (X_{jt}) will be accounted for using importer*year fixed effects.

³¹Note that the $X_{it} * AfricanImporter_j$ interaction variables do survive the exporter*year fixed effects because they vary by importing country.

these trade-offs, the subsequent tables will report results both with and without the exporter*year and importer*year fixed effects. Finally, robust standard errors are clustered at the exporter level.

5 Results

This section begins by examining whether the lack of intra-African trade can be explained by the typical gravity terms. The analysis then estimates how total exports respond to various country characteristics, and whether these factors disproportionately affect exports to other African countries.

5.1 Gravity

Column 1 of Table 1 reports results from a basic gravity specification that only includes year, exporter, and importer fixed effects. The results are consistent with standard findings that bilateral trade is increasing with exporter and importer GDP but decreasing with the distance between the trading partners.

The analysis then examines whether GDP and distance differentially affect exports to other African countries. This is accomplished by interacting GDP and distance with a binary variable indicating whether the importing country is also in Africa. The results reported in column 2 show that a ten percent increase in distance is associated with a 12% decrease in exports to non-African countries but an 18% decrease in export to African countries (the uninteracted distance coefficient is -1.2^{***} , while the interaction coefficient is -0.6^{**}). This indicates that distance is a larger impediment to intra-African trade.³²

While exports increase with exporter GDP, growth in economic size does not differentially affect exports to African countries, as seen by the insignificant interaction coefficient of 0.08 in column 2. However, results in Section 5.4 explore this issue more carefully and show that the sectoral composition of the domestic economy does have a differential affect on African exports.

³²This finding is consistent with Atkin and Donaldson (2015), who show that intra-national trade costs are 4-5 times larger in African countries than in the U.S.

TABLE 1
Gravity Determinants of Bilateral African Trade

	Exports			
	(1)	(2)	(3)	(4)
ln GDP	0.652*** [0.105]	0.644*** [0.107]	0.644*** [0.088]	
ln Population	-0.600 [0.425]	-0.579 [0.418]	-0.915** [0.393]	
ln Importer GDP	0.811*** [0.105]	0.816*** [0.105]	0.788*** [0.114]	
ln Importer Pop	0.762** [0.373]	0.670 [0.431]	0.953*** [0.258]	
ln Distance	-1.423*** [0.152]	-1.247*** [0.203]		
ln GDP * Afr Importer		0.077 [0.072]	0.037 [0.082]	0.131 [0.129]
ln Dist. * Afr Importer		-0.553** [0.215]		
Year FE	Yes	Yes	Yes	No
Exporter FE	Yes	Yes	No	No
Importer FE	Yes	Yes	No	No
Pair FE	No	No	Yes	Yes
Exporter*Year FE	No	No	No	Yes
Importer*Year FE	No	No	No	Yes
Observations	229,694	229,694	232,915	222,774

Notes: The dependent variable is bilateral exports. Estimation by PPML. The sample includes 54 African exporters, 236 African and non-African importers, and the years 1984-2016. Robust standard errors clustered at the exporter level in brackets. *** p<0.01, ** p<0.05, * p<0.1.

In lieu of exporter and importer fixed effects, column 3 includes country-pair fixed effects instead. This accounts for all time-invariant factors that determine trade between any two pairs of countries and focuses on changes over time. Since distance does not vary over time it is subsumed by these country-pair fixed effects. The specification in column 4 is even more rigorous by including exporter*year and importer*year fixed effects.³³ These fixed effects absorb GDP, population, and all other time-varying factors in the exporting and importing countries. The coefficient on the $GDP * AfricanImporter_j$ interaction term is positive and larger (compared to columns 2-3) but still insignificant.

Overall, the results in Table 1 suggest that the lack of African trade is not simply explained by the standard gravity terms. This findings is in contrast to the cross-sectional results in Foroutan and Pritchett (1993), Coe and Hoffmaister (1998), and Rodrik (1998) but consistent with Limao and Venables (2001). The following sections examine possible explanations for why intra-African trade may be different.

³³Together with the country-pair fixed effects, there are over nine thousand dummy variables included in this regression.

5.2 Trade Agreements

Trade agreements reduce tariff barriers and are found to increase trade (Baier and Bergstrand 2007), although the magnitude of this effect is open to debate (Rose 2004, Caliendo and Parro 2015).³⁴ The lack of trade agreements between African countries has traditionally been identified as a contributing factor to the low intra-continental trade share (Figure 3), as proponents of the African Continental Free Trade Agreement (AfCFTA) have argued. This section examines whether recent African trade agreements have increased the share of intra-African trade (Figure 4).

To estimate the impact of trade agreements on exports, the gravity specification includes indicator variables identifying whether an African country has a non-reciprocal, preferential, free trade, or customs union agreement with a partner country. Non-reciprocal trade agreements provide African countries preferential access to markets in developed countries while customs unions are exclusively between African countries. In contrast, African preferential and free trade agreements exist with both African and non-African partner countries, and the former agreements are more common than the latter (Table A3).

The relationship between trade agreements and exports is reported in Column 1 of Table 2, after accounting for GDP and population in both countries as well as year and country-pair fixed effects. Interestingly, the findings show that these trade agreements do not significantly affect exports, but these aggregate results may mask heterogeneous effects across African and non-African trading partner countries.³⁵

³⁴Furthermore, lower tariffs can reduce incentives for informal trade and thus increase measured trade flows.

³⁵Consistent with Head and Mayer (2014), trade agreements have a more positive impact on trade when estimated using an ordinary least squares (OLS) approach rather than the PPML estimation strategy (results available upon request).

TABLE 2
Impact of Trade Agreements on Bilateral African Trade

	Exports		
	(1)	(2)	(3)
Non-Reciprocal	-0.021 [0.088]	-0.006 [0.089]	-0.089 [0.129]
PTA	-0.062 [0.058]	-0.113* [0.060]	0.015 [0.100]
FTA	0.056 [0.071]	0.031 [0.076]	0.028 [0.085]
Customs Union	-0.173 [0.358]	-0.458 [0.324]	-0.136 [0.184]
PTA * Afr Importer		0.487*** [0.147]	0.448*** [0.172]
FTA * Afr Importer		-0.041 [0.085]	-0.295* [0.172]
Gravity Variables	Yes	Yes	Yes
Gravity Interactions	No	Yes	Yes
Year FE	Yes	Yes	No
Pair FE	Yes	Yes	Yes
Exporter*Year FE	No	No	Yes
Importer*Year FE	No	No	Yes
Observations	226,871	226,871	217,776

Notes: The dependent variable is bilateral exports. Estimation by PPML. The regressions include GDP, Pop, Importer GDP, Importer Pop, and the interaction terms GDP*African-importer and Pop*African-importer in columns 2 and 3. The sample includes 54 African exporters, 236 African and non-African importers, and the years 1984-2016. Robust standard errors clustered at the exporter level in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Column 2 examines whether preferential and free trade agreements disproportionately increase exports to other African countries. Specifically, the PTA and FTA variables are interacted with the binary variable indicating whether the importing country is also in Africa.³⁶ The positive and significant coefficient on the PTA interaction term shows that exports to African countries disproportionately increase with preferential trade agreements. This beneficial effect stems from the fact that PTAs are often adopted by African countries that previously had no trade agreements and the fact that in the absence of these agreements African tariffs are often quite high.³⁷

Intra-African trade continues to increase with preferential trade agreements in column 3 after accounting for both exporter*year and importer*year fixed effects. The coefficient on $PTA * AfrImporter_j$

³⁶Since non-reciprocal agreements and customs unions are with either non-African or African countries but not both, it is impossible to interact these types of agreements with the binary African importer variable.

³⁷South Africa, for instance, transitioned from having no trade agreement with Tanzania to a PTA in 2001. On the other hand, many African countries transition from non-reciprocal agreements to PTAs with non-African countries, which can explain the negative coefficient on the uninteracted PTA variable in column 2. For instance, South Africa moved from a non-reciprocal agreement with the U.K. to a PTA in 2010.

remains positive, statistically significant, and similar in magnitude.³⁸ Overall, these results show that preferential trade agreements increase intra-African trade. This confirms an intuitive but important point that trade agreements are an effective way of promoting economic cooperation and integration among African countries.

5.3 Infrastructure

Poor infrastructure impedes trade (Donaldson 2018) and is especially problematic in Africa (Jedwab and Storeygard 2019, Storeygard 2016). This may have adverse implications for both African international trade (Amjadi and Yeats 1995, Limao and Venables 2001, Longo and Sekkat 2004) and African intra-national trade (Atkin and Donaldson 2015). This section examines whether infrastructure disproportionately affects intra-African trade, which could explain why African exports decrease relatively quickly with distance (Table 1).

Table 3 begins by examining the relationship between infrastructure and total export. Of the five communication and transportation infrastructure measures included in column 1, African exports only increase with cell-phones.³⁹ However, specific types of infrastructure may differentially affect exports to African and non-African countries.

To explore this possibility, the transportation and communication infrastructure variables are interacted with a binary variable indicating that the importing country is also in Africa. Column 2 shows that exports to both African and non-African countries increase with cell-phones. The uninteracted cell-phone coefficient remains positive and significant (0.02*) but the coefficient on the cell-phone interaction term is insignificant. The most striking result in column 2 is the role that roads play in fostering trade between African countries. The uninteracted road coefficient indicates that roads do not significantly increase exports to non-African countries. However, the coefficient on the road interaction term is large, positive, and significant (0.988***). A ten percent increase in roads is associated with a 9% increase in exports to other African countries. Road infrastructure appears to be especially important in promoting intra-African trade.⁴⁰

Column 3 shows that the results are similar after including importer*year and exporter*year fixed effects. Exports to African countries increase with improvements in the road network. This indicates that

³⁸Note the interaction coefficient on FTAs is negative and weakly significant. These agreements are less common (Table A3) and the benefits of moving from a PTA to a FTA with another African country are less clear.

³⁹The inclusion of other infrastructure measures (i.e. rail, ports, and paved roads) reduces the sample size in half and none of these factors have a significant impact on exports.

⁴⁰Using a cross-sectional OLS gravity specification without any fixed effects, Piet et al. 2010 also find that roads are important in promoting trade in Africa.

intra-African exports are relatively sensitive to poor infrastructure, which can explain why trade between African countries decreases more quickly with distance (Table 1). Overall, these findings indicate that investments in infrastructure, and in particular roads, may be an effective way of promoting trade between African countries.

TABLE 3
Impact of Infrastructure on Bilateral African Trade

	Exports		
	(1)	(2)	(3)
ln Roads	0.016 [0.121]	-0.088 [0.100]	
ln Internet	0.014 [0.019]	0.012 [0.020]	
ln Cell Phones	0.023* [0.012]	0.021* [0.013]	
ln Phones	0.033 [0.021]	0.032 [0.021]	
ln Flights	0.015 [0.017]	0.017 [0.021]	
ln Roads * Afr Importer		0.988*** [0.345]	1.001*** [0.258]
ln Internet * Afr Importer		0.037 [0.040]	0.030 [0.031]
ln Cell Phones * Afr Importer		0.036 [0.038]	-0.029 [0.025]
ln Phones * Afr Importer		-0.010 [0.042]	-0.008 [0.020]
ln Flights * Afr Importer		-0.013 [0.031]	0.020 [0.037]
Gravity Variables	Yes	Yes	Yes
Gravity Interactions	No	Yes	Yes
Year FE	Yes	Yes	No
Pair FE	Yes	Yes	Yes
Exporter*Year FE	No	No	Yes
Importer*Year FE	No	No	Yes
Observations	232,660	232,660	222,521

Notes: The dependent variable is bilateral exports. Estimation by PPML. The regressions include GDP, Pop, Importer GDP, Importer Pop, and the interaction terms GDP*African-importer and Pop*African-importer in columns 2 and 3. The sample includes 54 African exporters, 236 African and non-African importers, and the years 1984-2016. Robust standard errors clustered at the exporter level in brackets. *** p<0.01, ** p<0.05, * p<0.1.

5.4 Composition of Economy

The sectoral composition of the domestic economy is important for the development process (Imbs and Wacziarg 2003, Cadot et al. 2011). If African countries specialize in a similar set of homogeneous

products, there will be less incentive for intra-African trade (Brookings 2012). Furthermore, specialization in products, like natural resources, that happen to be in high demand in developed countries could also lead to declines in intra-African trade. This section examines whether the composition of the domestic economy influences trade between African countries.

To test for this possibility, GDP in the exporting country in equation 1 is replaced with the size of four domestic sectors: agriculture, natural resources, manufacturing, and services. The findings in column 1 of Table 4 show that total exports increase with the size of the agricultural and natural resource sector. A ten percent increase in the agriculture or natural resource sector is associated with a 2.3% and 2.4% increase in exports, respectively.

The impact of sectoral growth on exports to different trading partners is examined in column 2. Exports to non-African countries increase with growth in the agriculture, natural resource (NR), and manufacturing sectors of the domestic economy. This is consistent with the standard gravity finding (see Table 1) that trade increases with exporter GDP. Exports increase relatively quickly with growth in the first two sectors, which is consistent with global demand for African tea, cocoa, cotton, oil, gems, and minerals.

The relationship between sectoral growth and exports to African countries is more heterogeneous (see columns 2 and 3). For example, a ten percent increase in the natural resource sector is associated with essentially no change in exports to African countries.⁴¹ This is consistent with the idea that specialization in a similar set of homogeneous products (i.e. oil), which are in high demand in developed countries, does not promote intra-African trade. However, exports to African countries do increase with growth in the service sector. A ten percent increase in the domestic service sector is associated with a 3.6% increase in exports to other African countries, but no increase in non-African exports.⁴² A differentiated industry like services may be more conducive to intra-industry trade with similar neighboring countries. The fact that exports to African countries increase with some domestic sectors and decrease with others, explains why overall GDP does not differentially affect intra-African trade in Table 1.

⁴¹In column 2 the sum of the uninteracted NR coefficient (0.25) and interaction NR coefficient (0.21) is close to zero and in column 3 the NR interaction coefficient is similar in magnitude and statistically significant.

⁴²In column 2 the sum of the uninteracted service coefficient (-0.03) and interaction service coefficient (0.39) is 0.36 and in column 3 this interaction coefficient is similar in magnitude and statistically significant.

TABLE 4
Impact of Domestic Industry Composition on Bilateral African Trade

	Exports		
	(1)	(2)	(3)
ln Agriculture	0.232** [0.115]	0.259** [0.124]	
ln Natural Resources	0.241** [0.111]	0.252** [0.117]	
ln Manufacturing	0.132 [0.091]	0.163* [0.093]	
ln Services	0.006 [0.119]	-0.030 [0.112]	
ln Agr * Afr Importer		-0.114 [0.291]	0.067 [0.165]
ln NR * Afr Importer		-0.206 [0.135]	-0.206** [0.101]
ln Manuf * Afr Importer		-0.408* [0.219]	-0.132 [0.148]
ln Serv * Afr Importer		0.385 [0.321]	0.371* [0.206]
Gravity Variables	Yes	Yes	Yes
Gravity Interactions	No	Yes	Yes
Year FE	Yes	Yes	No
Pair FE	Yes	Yes	Yes
Exporter*Year FE	No	No	Yes
Importer*Year FE	No	No	Yes
Observations	232,915	232,915	222,774

Notes: The dependent variable is bilateral exports. Estimation by PPML. The independent variables measure the log size of the domestic Agricultural, Natural Resource and Construction, Manufacturing, and Service industries. The regressions include Pop, Importer GDP, Importer Pop, and the interaction term Pop*African-importer in columns 2 and 3. The sample includes 54 African exporters, 236 African and non-African importers, and the years 1984-2016. Robust standard errors clustered at the exporter level in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Overall, both total exports as well as the destination of these exports are found to be influenced by the composition of the domestic African economy. According to these results, one strategy to increase intra-African trade would be to promote diversification of the domestic economy out of the natural resource sector and towards services.

5.5 Corruption

Institutional quality and contract enforcement are both important determinants of trade (Nunn 2007 and Levchenko 2007). Conversely, inefficiencies and corruption, especially in the trading and customs clearing system, can impede international trade (Djankov, Freund, and Pham 2010, Rijkers et al. 2020). This is especially problematic in many African countries (Acemoglu and Robinson 2010, Sequeira and Djankov

2014). This section explores whether corruption adversely affects African exports.⁴³

Table 5 examines the relationship between exports and two measures of corruption related to international trade. The *Trade Corruption* measure reflects the time and costs associated with trading across borders and the *Customs Corruption* variable measures the inefficiency of the customs clearance process. The results in column 1 show that total exports decrease with the level of trade corruption, but not with customs corruption.⁴⁴

The next two columns explore whether corruption disproportionately affects exports to other African countries. While the findings in column 2 are less conclusive, the more rigorous specification with exporter*year and importer*year fixed effects (column 3) show that exports to African countries decrease with both types of corruption. The point estimates show, for instance, that a standard deviation increase in trade corruption (0.42 in Table A3) and in customs corruption (0.11) is associated with a 0.31% and a 0.06% decrease in relative exports to African countries. Of the two corruption measures, the former effect is larger in magnitude and more significant. Overall, these results show that intra-African trade decreases with corruption associated with international trade.⁴⁵

⁴³It is worth noting that in some situations, corruption may actually help facilitate trade, especially if it allows firms to evade high tariff barriers (Dutt and Traca 2010, Sequeira and Djankov 2014, Olney 2016, Sequeira 2016).

⁴⁴The point estimate of -0.42 shows that a standard deviation increase in trade corruption (0.42 in Table A3) is associated with a 0.18% decline in exports.

⁴⁵The Doing Business (DB) and Logistic Performance Index (LPI) measures of overall corruption are not significantly related to exports (results available upon request). Thus, it is corruption specific to international trade and not corruption in general that influences trade flows.

TABLE 5
Impact of Corruption on Bilateral African Trade

	Exports		
	(1)	(2)	(3)
ln Trade Corruption	-0.420** [0.211]	-0.413* [0.232]	
ln Customs Corruption	0.278 [0.261]	0.289 [0.275]	
ln Trade Corruption * Afr Importer		0.066 [0.319]	-0.737*** [0.234]
ln Customs Corruption * Afr Importer		-0.035 [0.311]	-0.554* [0.309]
Gravity Variables	Yes	Yes	Yes
Gravity Interactions	No	Yes	Yes
Year FE	Yes	Yes	No
Pair FE	Yes	Yes	Yes
Exporter*Year FE	No	No	Yes
Importer*Year FE	No	No	Yes
Observations	224,135	224,135	214,215

Notes: The dependent variable is bilateral exports. Estimation by PPML. The regressions include GDP, Pop, Importer GDP, Importer Pop, and the interaction terms GDP*African-importer and Pop*African-importer in columns 2 and 3. The sample includes 54 African exporters, 236 African and non-African importers, and the years 1984-2016. Robust standard errors clustered at the exporter level in brackets. *** p<0.01, ** p<0.05, * p<0.1.

5.6 Conflict

Conflict leads to instability and uncertainty which can adversely affect international trade (Heilmann 2016 and Amodio and Di Maio 2018).⁴⁶ Furthermore, conflict is especially prevalent in Africa (McGuirk and Burke 2017), which may contribute to the relatively low intra-continental trade share. To test for this possibility, this section examines the relationship between African exports and two different measures of conflict.

The findings show that total exports decline with violence, while there is no relationship between conflict deaths and trade (see column 1 of Table 6). The former effect is due to exports to non-African countries decreasing with violence (column 2), while exports to African countries do not. Developed countries may be especially apprehensive about entering into business relationships with African countries where violence is problematic. The results in column 2 do show that exports to African countries

⁴⁶Heilmann (2016) uses consumer boycotts as a measure of conflict, while this paper relies on more conventional measures of conflict deaths and violence. Unlike Amodio and Di Maio (2018), this analysis focuses on the relationship between conflict and exporting rather than importing. Martin, Mayer and Thoenig (2008) find that bilateral trade decreases the likelihood of military conflict, while multilateral trade increases the likelihood of conflict.

disproportionately decrease with conflict deaths, perhaps because conflict is often with a neighboring trading partner country. However, these results should be interpreted with caution because the inclusion of exporter*year and importer*year fixed effects in column 3 leads to an insignificant relationship between both measures of conflict and African exports.

TABLE 6
Impact of Conflict on Bilateral African Trade

	Exports		
	(1)	(2)	(3)
In Conflict Deaths	0.000 [0.015]	0.009 [0.014]	
In Violence	-0.076** [0.036]	-0.086** [0.035]	
In Conflict Deaths * Afr Importer		-0.096*** [0.028]	-0.016 [0.022]
In Violence * Afr Importer		0.164 [0.135]	-0.088 [0.088]
Gravity Variables	Yes	Yes	Yes
Gravity Interactions	No	No	Yes
Year FE	Yes	Yes	No
Pair FE	Yes	Yes	Yes
Exporter*Year FE	No	No	Yes
Importer*Year FE	No	No	Yes
Observations	226,004	226,004	216,079

Notes: The dependent variable is bilateral exports. Estimation by PPML. The regressions include GDP, Pop, Importer GDP, Importer Pop, and the interaction terms GDP*African-importer and Pop*African-importer in columns 2 and 3. The sample includes 54 African exporters, 236 African and non-African importers, and the years 1984-2016. Robust standard errors clustered at the exporter level in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Overall, the results in Table 6 are mixed. Unlike many of the other explanations explored in this paper, these findings show a less significant relationship between conflict and intra-African trade. Thus, while conflict has numerous adverse societal and economic ramifications, it does not appear to be the most important obstacle to trade between African countries.

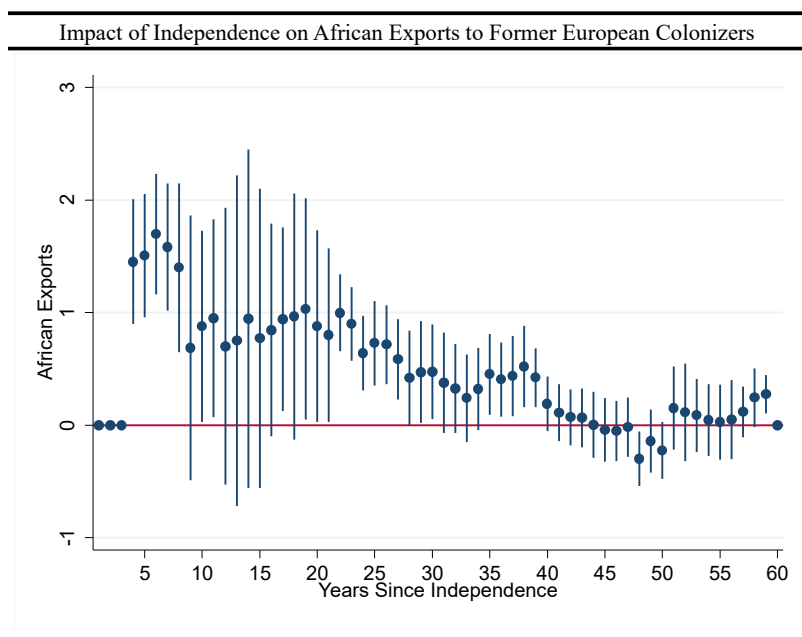
5.7 Colonial Relationships

This section examines whether vestiges of European colonialism influences African trade flows. European colonization can have lasting economic implications (Acemoglu, Johnson, and Robinson 2001), which may be especially relevant for African countries (Acemoglu and Robinson 2010). After independence the destination of export flows may slowly diversify away from a former European colonizer (Head, Mayer,

and Reis, 2010), as the impact of extractive institutions and infrastructure fade and trade networks with the former colonial power dissipate.

Independence dummies ($Indep1_{ijt}$ to $Indep60_{ijt}$) are included in equation 1 and capture the effect of years since independence on bilateral trade to a former European colonizer. Figure 6 plots the point estimates and the 95% confidence intervals on each of these independence binary variables.⁴⁷ The findings show African countries initially export more to their former European colonizer than the gravity predicts. However, these positive bilateral export flows steadily decline after independence. Finally, forty years after independence, African countries are no more likely to export to their former colonizer. These findings are consistent with the existing literature (Head, Mayer, and Reis, 2010) and show that European colonization has had a lasting impact on African trade flows. This decline in African exports to former European colonizers likely contributes to the rise in the intra-African trade share over the sample period (Figure 4).

FIGURE 6



Notes: The dependent variable is bilateral exports. Estimation by PPML. Coefficient estimates and 95% confidence intervals are reported on independence dummies, which indicate the number of years since independence from a European colonizer post 1900. Regression controls for GDP, Pop, Importer GDP, Importer Pop, bilateral pair fixed effects, and year fixed effects. The sample includes 54 African exporters, 236 African and non-African importers, and the years 1984-2016. Robust standard errors clustered at the exporter level in brackets.

⁴⁷The first three dummies ($Indep1 - 3$) are omitted because the sample begins in 1984 and Zimbabwe's independence from the U.K. in 1980 was the last in Africa (see Table A2).

5.8 Unified Empirical Analysis

An important contribution of this paper is to combine the various possible explanations for intra-African trade into a unified empirical framework. This section focuses on the most promising characteristics identified in the previous sections and examines the impact of these factors on both total exports and exports to other African countries.⁴⁸

In column 1, total exports increase with the natural resource sector, surprisingly they decrease with preferential trade agreements, and they are insensitive to many of the other domestic factors. The next two columns of Table 7 explore whether these factors disproportionately affect trade with other African countries. The positive and significant PTA interaction coefficient in column 2 indicates that exports to African countries disproportionately increase with PTAs. The results also show a large positive relationship between road infrastructure and exports to African countries. In contrast, the road network does not significantly affect non-African exports. The results in column 2 also show that non-African exports increase with the natural resource sector, but growth in this industry has little bearing on exports to other African countries. This is consistent with evidence in Figure 5 showing that oil producing countries tend to have low intra-African trade shares.

Road infrastructure continues to be one of the most important predictors of intra-African trade after exporter*year and importer*year fixed effects are included in column 3. These findings also show that exports to African countries disproportionately decrease with the size of the natural resource sector but increase with the size of the service sector.⁴⁹ As African countries diversify away from natural resources and towards services, intra-African trade increases. Finally, exports to African countries disproportionately decrease with trade corruption (column 3) and with conflict deaths (column 2).

Overall, these findings offer insights into ways to promote economic integration between African countries. Specifically, investments in roads, pursuing trade agreements, encouraging the domestic economy to diversify into the service sector, and reducing corruption appear to be the most effective ways of encouraging intra-African trade.

⁴⁸Including all of the explanatory variables from the previous sections does not change the results and is cumbersome to report (results available upon request).

⁴⁹The point estimates on these sectoral variables are similar in columns 2 and 3, but with the exporter*year and importer*year fixed effects the coefficients are significant.

TABLE 7
Bilateral African Trade

	Exports		
	(1)	(2)	(3)
PTA	-0.124** [0.062]	-0.198*** [0.063]	-0.005 [0.100]
ln Roads	-0.027 [0.129]	-0.179 [0.119]	
ln Agriculture	0.187 [0.116]	0.231* [0.127]	
ln Natural Resources	0.241** [0.107]	0.262** [0.114]	
ln Manufacturing	0.115 [0.098]	0.142 [0.099]	
ln Services	0.036 [0.109]	-0.012 [0.113]	
ln Trade Corruption	-0.227 [0.231]	-0.261 [0.239]	
ln Conflict Deaths	-0.012 [0.010]	-0.005 [0.010]	
PTA * Afr Importer		0.536*** [0.127]	0.136 [0.142]
ln Roads * Afr Importer		1.220*** [0.364]	0.618** [0.310]
ln Agr * Afr Importer		-0.112 [0.246]	-0.03 [0.139]
ln NR * Afr Importer		-0.193 [0.135]	-0.222** [0.098]
ln Manuf * Afr Importer		-0.415** [0.191]	-0.163 [0.144]
ln Serv * Afr Importer		0.285 [0.229]	0.393*** [0.127]
ln Trade Corruption * Afr Importer		0.382 [0.242]	-0.690*** [0.260]
ln Conflict Deaths * Afr Importer		-0.069*** [0.025]	-0.002 [0.019]
Year FE	Yes	Yes	No
Pair FE	Yes	Yes	Yes
Exporter*Year FE	No	No	Yes
Importer*Year FE	No	No	Yes
Observations	226,487	226,487	217,394

Notes: The dependent variable is the log of bilateral exports. Estimation by PPML. The regressions include GDP, Pop, Importer GDP, Importer Pop, and the interaction term Pop*African-importer in columns 2 and 3. Columns 2 and 3 report the uninteracted coefficients and the African interaction coefficients from the same regressions in two separate subcolumns. The sample includes 54 African exporters, 236 African and non-African importers, and the years 1984-2016. Robust standard errors clustered at the exporter level in brackets. *** p<0.01, ** p<0.05, * p<0.1.

6 Conclusion

Understanding the determinants of Africa's slow economic growth is a crucially important question. One explanation is the continent's lack of international trade. This paper documents Africa's relatively low share of intra-continental exports and identifies reforms that can promote trade between African countries.

The paper assembles a comprehensive data set spanning all African countries over the past three decades to examine the importance of a variety of explanations for African exporting behavior. The analysis improves upon existing studies by using a more rigorous empirical specification, which is able to control for a wide variety of potentially confounding factors.

The first key result is that the lack of African trade is not simply explained by the standard gravity terms. For example, exports to African countries decreases more quickly with distance than exports to non-African countries. The analysis then explores how domestic conditions within African countries affect both total exports and more importantly exports to other African countries. The findings show that intra-African exports disproportionately increase with road infrastructure, trade agreements, the diversification of the domestic economy away from natural resources and towards services, and a reduction in corruption. These findings can inform efforts to promote African economic integration.

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A ONLINE APPENDIX

A.1 Sample of Countries

TABLE A1
List of African Countries

Algeria	Liberia
Angola	Libya
Benin	Madagascar
Botswana	Malawi
Burkina Faso	Mali
Burundi	Mauritania
Cabo Verde	Mauritius
Cameroon	Morocco
Central African Republic	Mozambique
Chad	Namibia
Comoros	Niger
Congo, Dem. Rep.	Nigeria
Congo, Rep.	Rwanda
Cote d'Ivoire	Sao Tome and Principe
Djibouti	Senegal
Egypt, Arab Rep.	Seychelles
Equatorial Guinea	Sierra Leone
Eritrea	Somalia
Eswatini	South Africa
Ethiopia	South Sudan
Gabon	Sudan
Gambia, The	Tanzania
Ghana	Togo
Guinea	Tunisia
Guinea-Bissau	Uganda
Kenya	Zambia
Lesotho	Zimbabwe

Notes: The sample includes these 54 African exporters, as well as 236 African and non-African importers over the years 1984-2016.

A.2 Dates of Independence

TABLE A2
European Colonizers, African Colonies, and Independence Dates since 1900

%					
<u>France</u>		<u>United Kingdom</u>		<u>Belgium</u>	
Algeria	1962	Botswana	1966	Burundi	1962
Benin	1960	Egypt, Arab Rep.	1922	Congo, Dem. Rep.	1960
Burkina Faso	1960	Eritrea	1952	Rwanda	1962
Cameroon	1960	Eswatini	1968		
Central African Rep.	1960	Gambia, The	1965		
Chad	1960	Ghana	1957	<u>Italy</u>	
Comoros	1975	Kenya	1963	Eritrea	1941
Congo, Rep.	1960	Lesotho	1966	Libya	1951
Cote d'Ivoire	1960	Malawi	1964		
Djibouti	1977	Mauritius	1968		
Gabon	1960	Nigeria	1960	<u>Portugal</u>	
Guinea	1958	Seychelles	1976	Angola	1975
Madagascar	1960	Sierra Leone	1961	Cabo Verde	1975
Mali	1960	Somalia	1960	Guinea-Bissau	1974
Mauritania	1960	South Africa	1910	Mozambique	1975
Morocco	1956	Sudan	1956	Sao Tome and Principe	1975
Niger	1960	Tanzania	1964		
Senegal	1960	Uganda	1962		
Togo	1960	Zambia	1964	<u>Turkey</u>	
Tunisia	1956	Zimbabwe	1980	Libya	1911
<u>Spain</u>		<u>Netherlands</u>			
Equatorial Guinea	1968	South Africa	1902		

Notes: Dates of independence of African countries (since 1900) from European colonizers.

A.3 Descriptive Statistics

TABLE A3
Summary Statistics

	Obs	Mean	Std. Dev.		Obs	Mean	Std. Dev.
<u>Gravity Terms</u>				<u>Trade Agreements</u>			
Exports	313,442	28,034	386,658	Non-Reciprocal	276,554	0.18	0.38
ln (GDP)	299,590	22.49	1.61	PTA	276,554	0.11	0.31
ln (Pop)	312,702	15.80	1.52	FTA	276,554	0.03	0.17
ln (GDP Importer)	245,481	23.74	2.38	Customs Union	276,554	0.01	0.09
ln (Pop Importer)	261,874	15.58	2.11				
ln (Distance)	301,462	8.68	0.68				
<u>Infrastructure</u>				<u>Composition of Economy</u>			
ln Roads	313,177	9.89	1.45	ln Agriculture	299,590	20.76	1.71
ln Internet	312,702	8.16	5.41	ln Natural Resources	299,590	20.22	1.93
ln Cell Phones	313,442	8.91	6.58	ln Manufacturing	299,590	20.14	1.86
ln Phones	313,442	10.97	2.07	ln Services	299,590	21.64	1.65
ln Flights	313,177	8.21	1.96				
<u>Corruption</u>				<u>Conflict</u>			
ln Trade Corruption	307,799	3.97	0.42	ln Conflict Deaths	313,442	0.79	1.90
ln Customs Corruption	303,313	1.02	0.11	ln Violence	302,156	0.08	0.34

A.4 Data Appendix

Given this paper's focus on developing African countries, the data can occasionally be difficult to obtain and incomplete. This section discusses in more detail the data sources and the construction of the variables used in this analysis.

The World Trade Flow (WTF) data set provides a comprehensive picture of African trade. Of the 54 African countries in the sample, the only Eritrea and Ethiopia prior to 1993, Botswana, Lesotho, Namibia, and South African prior to 2000, and Sudan from 2008-2011 are missing export data. These observations are not included in the analysis.⁵⁰

Trade agreement data comes from the Economic Integration Agreements (EIA) database and measures the degree of economic integration between every pair of countries. Using the EIA's index (which ranges from 0 to 6), four binary variables are constructed indicating a non-reciprocal agreement, a preferential

⁵⁰ As long as a country's bilateral export flows are not missing to all trading partners, these zeros are included in the analysis.

agreement (PTA), a free trade agreement (FTA), or a customs union.⁵¹ These binary variables are nested from least to most trade integration. For example, all customs unions are considered a type of preferential agreement but not all preferential agreements are a customs union. This avoids the preferential agreement variable switching to zero in the dataset, if for instance a country moves from a PTA to a customs union.⁵² Finally, the EIA data is available from 1984-2012, and thus trade agreements in 2012 are used for the subsequent years.

Infrastructure measures come from the World Bank's African Development Indicators (ADI) and the World Development Indicators (WDI) data sets. Specifically, the total road network in kilometers in a given African country and year (1990-2010) comes from the ADI. Data on individual internet users, fixed telephone subscriptions, mobile cellular subscriptions, and registered flight departures comes from the WDI dataset for the 1984-2016 period.⁵³ Missing infrastructure, road, internet, phone, and flight data is identified using linear interpolation and nearest neighbor extrapolation.⁵⁴ There are other potentially appealing variables in the WDI, but unfortunately the coverage is incomplete for these infrastructure variables which limits their usefulness (i.e. rail network and container port traffic).

The WDI has data on the GDP share of four sectors of the domestic economy: agriculture (which also includes forestry and fishing; ISIC 1-5), natural resources (which also includes construction; ISIC 10-14 and 40-45), manufacturing (ISIC 15-37), and services (ISIC 50-99).⁵⁵ This data spans the years 1984-2016 for most countries, and the occasional missing value is identified using linear interpolation and nearest neighbor extrapolation. These sectoral shares are then multiplied by GDP to obtain the size of the agriculture, natural resource, manufacturing, and service sectors for each African country over the sample period.

Corruption is measured using trade related components of the Doing Business (DB) index and the Logistic Performance Index (LPI), both from the World Bank. Specifically, the 'trading across borders' subindex from the DB data set is used, which ranges from 0 to 100 (with 100 being the best performance) and measures the time and costs associated with the logistics of exporting and importing. This includes documentary compliance, border compliance, and domestic transport, but not tariffs. A 'trade corruption'

⁵¹There is also data on common markets and economic unions but these are rare in Africa.

⁵²For similar reasons, PTA and FTAs are classified as a type of non-reciprocal agreement, but only for non-African countries where non-reciprocal agreements are relevant.

⁵³There are no internet users and cell phones prior to the mid-1990s.

⁵⁴Nearest neighbor extrapolation (i.e. using 1985's value for 1984 or using 2015's value for 2016) is preferable to linear extrapolation which can lead to implausibly small or large values over a sufficient time frame.

⁵⁵The natural resources and construction sector is calculated as the difference between the WDI's Industry and Manufacturing sectors. The rare missing Manufacturing observation (i.e. <5% of the sample) is identified using the size of the Industry sector and a country's average Manufacturing share from other years.

measure is calculated as one hundred minus this DB trading across border subindex. In addition, the 'efficiency of the customs clearance process' subindex from the LPI dataset is used, which ranges from 1 to 5 (with 5 being the best performance) and measures customs efficiency (i.e. speed, simplicity, and predictability). A 'customs corruption' measure is calculated as five minus this LPI customs efficiency subindex.⁵⁶

The number of armed conflict deaths in a given country and year is measure using data from the Uppsala Conflict Data Program (1989-2016). These include deaths related to armed force between two parties, at least one of which is the government of a state. A different measure of conflict is obtained from the Center for Systemic Peace. This index (0-10) measures major episodes of political violence (MEPV) within a country and year (1984-2016), which is the sum of international war, international violence, civil war, civil violence, ethnic war, and ethnic violence.⁵⁷

Any analysis of developing African countries over a thirty three year period (1984-2016) will face some data constraints. The interpolation and extrapolation methods are not perfect but they are a sensible and common approach for handling missing observations. If anything they will lead to less time-series variation within a country, which should attenuate the results.⁵⁸ This section outlines, hopefully in a transparent way, the approaches used to address these inherent data challenges.

⁵⁶Missing observations are identified using linear interpolation and nearest neighbor extrapolation.

⁵⁷Conflict death missing observations are identified using linear interpolation and nearest neighbor extrapolation. The violence variable has near complete coverage, with the few missing observations for Eritrea, Namibia, and Sudan identified using nearest neighbor extrapolation.

⁵⁸For example, values early in the sample that are identified using nearest neighbor extrapolation will be subsumed by the exporter (or pair) fixed effects because they do not vary over time.